PATENT ABSTRACTS OF JAPAN

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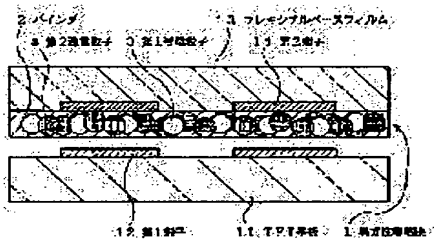
(54) ANISOTROPIC ELECTROCONDUCTIVE FILM

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an anisotropic electroconductive film to prevent an electrostatic break of the devices on 1st and 2nd substrates caused by intrusion of static electricity from horizontal direction when the 1st and the 2nd substrates are bound one over the other, by the intervention of the film.

SOLUTION: This anisotropic electroconductive film 1 is formed by mixing the 1st electroconductive particle 3 and the 2nd electroconductive particle 4 which has a higher resistance than that of the conductive particle 3 in a binder 2 comprising an insulating material. The 1st conductive particle 3 is in the state that a TFT substrate (1st substrate) 11 is adhered to a flexible base film (2nd substrate) 13 and in contact with a 1st terminal 12 and a 2nd terminal 14, and, in addition, mixed in the binder 2 in such a density as it is not in contact with the neighboring 1st conductive particle 3. The 2nd conductive particle 4 is in the state that a TFT substrate 11 is adhered to a flexible base film 13 and mixed in the binder 2 in such a density as it is in contact with the 2nd conductive particle 4.



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CLAIMS

[Claim(s)]
[Claim 1] It is the anisotropy electric conduction film for pasting up these 1st substrates and the 2nd substrate in the condition of having made it intervening between the 1st substrate and the 2nd substrate, and having made it flowing through the terminal of this 1st substrate, and the terminal of said 2nd substrate which counters this terminal. The binder which consists of an insulating material, and the 1st electric conduction particle mixed into this binder, It has the 2nd electric conduction particle which was mixed into said binder and has resistance higher than the resistance of said 1st electric conduction particle. Said 1st electric conduction particle It is mixed into said binder by the consistency which does not contact the 1st electric conduction particle which contacts and adjoins the terminal of this 1st substrate, and the terminal of the 2nd substrate where said 1st substrate and 2nd substrate are pasted up. Said 2nd electric conduction particle is anisotropy electric conduction film characterized by coming to be mixed by the consistency in contact with the 2nd electric conduction particle which adjoins where said 1st substrate and 2nd substrate are pasted up into said binder.
[Claim 2] It is the anisotropy electric conduction film for pasting up these 1st substrates and the 2nd substrate in the condition of having made it intervening between the 1st substrate and the 2nd substrate, and having made it flowing through the terminal of this 1st substrate, and the terminal of said 2nd substrate which counters this terminal. An electric conduction particle is the thing which it comes to mix into a binder. Said electric conduction particle It is mixed into said binder by the consistency which does not contact the electric conduction particle which contacts and adjoins the terminal of this 1st substrate, and the terminal of the 2nd substrate where said 1st substrate and 2nd substrate are pasted up. Said binder Anisotropy electric conduction film characterized by consisting of an ingredient which has resistance higher than the resistance of said electric conduction particle.

[Translation done.]

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the anisotropy electric conduction film used for connection between the circuit boards in electronic equipment.
[0002]
[Description of the Prior Art] There is a technique of using the anisotropy electric conduction film for one of the connection techniques between the circuit boards in electronic equipment. Conventionally, this technique is applied to connection between a rigid (hard) substrate and a flexible substrate, or connection of flexible substrates. Especially, in manufacture of a liquid crystal display component (it is hereafter described as LCD), a flexible substrate is used for connection between LCD and an external circuit substrate in many cases. Using the anisotropy electric conduction film 60 for connection with the TFT (thin film transistor) substrate 51 of LCD and the flexible substrate 53 which are a rigid substrate as recent years show to drawing 5 R> 5 from this is proposed.
[0003] Usually, the anisotropy electric conduction film 60 makes the electric conduction particle 62 which has low contact resistance mix into the binder (base material) 61 which is adhesives, and consists of what formed this in the shape of film. In the connection using the anisotropy electric conduction film 60, the TFT substrate 51 and the flexible substrate 53 are pasted up by, making the anisotropy electric conduction film 60 intervene between the TFT substrate 51 and the flexible substrate 53 for example, and applying a pressure in the thickness direction of the anisotropy electric conduction film 60 in this condition. In the case of that adhesion, between the terminal electrode 52 of the TFT substrate 51, and the electrode 54 of the flexible substrate 53 which counters this terminal electrode 52, the electric conduction particle 62 in a binder 61 is crushed, and the flow between the terminal electrode 52 and an electrode 54 (the vertical direction) is obtained. In addition, where the TFT substrate 51 and the flexible substrate 53 are pasted up, in order to secure lateral insulation, the electric conduction particle 62 of the anisotropy electric conduction film 60 is mixed into the binder 61 by the consistency of adjoining extent which does not carry out thing contact.
[0004] Thus, lateral insulation was maintained and the anisotropy electric conduction film 60 has secured the anisotropy as a result, while a flow of the vertical direction is taken by the electric conduction particle 62, when a pressure is able to be applied in the thickness direction.
[0005]
[Problem(s) to be Solved by the Invention] By the way, the anisotropy electric conduction film has been conventionally developed focusing on the reduction in resistance and anisotropy of the flow. For this reason, by the current anisotropy electric conduction film with lateral high insulation, when static electricity invades, for example from the terminal at the tip of a flexible substrate, while that potential difference had been maintained, it is impressed by the device of LCD. As a result, the device received the damage with static electricity and the fault that the electrostatic discharge of the LCD is carried out has arisen.
[0006]
[Means for Solving the Problem] The anisotropy electric conduction film applied to claim 1 in order to solve the above-mentioned technical problem The binder which is for pasting up these 1st substrates and the 2nd substrate in the condition of having made it intervening between the 1st substrate and the 2nd substrate, and having made it flowing through the terminal of the 1st substrate, and the terminal of the 2nd substrate which counters this terminal, and consists of an insulating material, It comes to have the 1st electric conduction particle mixed into the binder, and the 2nd electric conduction particle which was mixed into the binder and has resistance higher than the resistance of the 1st electric conduction particle. And it comes into a binder to be mixed by the consistency which does not contact the 1st electric conduction particle from which the above-mentioned 1st electric conduction particle contacts and adjoins the terminal of the 1st substrate, and the terminal of the 2nd substrate where the 1st substrate and the 2nd substrate are pasted up. Moreover, it comes into a binder to mix the above-

mentioned 2nd electric conduction particle by the consistency in contact with the 2nd electric conduction particle which adjoins where the 1st substrate and the 2nd substrate are pasted up.

[0007] By the anisotropy electric conduction film of this invention, when making it intervene between the 1st substrate and the 2nd substrate and pasting up the 1st substrate and the 2nd substrate, the 1st electric conduction particles by which the 1st electric conduction particle contacts and adjoins the terminal of the 1st substrate and the terminal of the 2nd substrate which counters this terminal do not contact. For this reason, the terminal of the 1st substrate and the terminal of the 2nd substrate flow through the 1st electric conduction particle. On the other hand, what the 2nd electric conduction particle adjoins contacts. Since this 2nd electric conduction particle has resistance higher than the resistance of the 1st electric conduction particle, the conductivity of high resistance is obtained rather than the resistance of the 1st electric conduction particle in the longitudinal direction between the terminals of the 1st substrate and the 2nd substrate by the 2nd electric conduction particle. Moreover, since a current flows to the low 1st electric conduction particle of resistance even if it contacts the terminal of the 1st substrate, and the terminal of the 2nd substrate, effect does not have the 2nd electric conduction particle in the conductivity of the terminal of the 1st substrate, and the terminal of the 2nd substrate.

[0008] It is for pasting up these 1st substrates and the 2nd substrate in the condition of having made the anisotropy electric conduction film concerning claim 2 intervening between the 1st substrate and the 2nd substrate, and having made it flowing through the terminal of the 1st substrate, and the terminal of the 2nd substrate which counters this terminal, and comes to mix an electric conduction particle into a binder. And it comes into a binder to be mixed by the consistency which does not contact the electric conduction particle from which the above-mentioned electric conduction particle contacts and adjoins the terminal of the 1st substrate, and the terminal of the 2nd substrate where the 1st substrate and the 2nd substrate are pasted up. Moreover, a binder consists of an ingredient which has resistance higher than the resistance of an electric conduction particle.

[0009] By the anisotropy electric conduction film of this invention, when making it intervene between the 1st substrate and the 2nd substrate and pasting up the 1st substrate and the 2nd substrate, the 1st electric conduction particles by which the 1st electric conduction particle contacts and adjoins the terminal of the 1st substrate and the terminal of the 2nd substrate which counters this terminal do not contact. For this reason, the terminal of the 1st substrate and the terminal of the 2nd substrate flow through the 1st electric conduction particle. On the other hand, since a binder has resistance higher than the resistance of the 1st electric conduction particle, the conductivity of high resistance is obtained rather than the resistance of the 1st electric conduction particle with a binder in the longitudinal direction between the terminal of the 1st substrate, and the terminal of the 2nd substrate. Moreover, since a binder flows to the 1st electric conduction particle of resistance with a low current even if it contacts the terminal of the 1st substrate, and the terminal of the 2nd substrate, it is uninfluential to the conductivity of the terminal of the 1st substrate, and the terminal of the 2nd substrate.

[0010]

[Embodiment of the Invention] Hereafter, the operation gestalt of the anisotropy electric conduction film concerning this invention is explained based on a drawing. In addition, this operation gestalt describes the case where this invention is applied to connection with the flexible base film for a signal input which is the TFT substrate and the 2nd substrate of LCD which are the 1st substrate. Drawing 1 is drawing explaining the anisotropy electric conduction film concerning the 1st operation gestalt, and shows 1 operation gestalt of invention of claim 1.

[0011] This anisotropy electric conduction film 1 is for making it intervene between the TFT substrate 11 and the flexible base film 13, and pasting up these TFT(s) substrate 11 and the flexible base film 13. Moreover, it is for making it flow through the terminal electrode (for it to be hereafter described as the 1st terminal) 12 of the TFT substrate 11, and the electrode (for it to be hereafter described as the 2nd

terminal) 14 of the flexible base film 13 which counters this 1st terminal 12 in the condition of having pasted up.

[0012] The anisotropy electric conduction film 1 is formed in the shape of film from the 1st electric conduction particle 3 and the 2nd electric conduction particle 4 which were mixed into the binder 2 which consists of an insulating material, and the binder 2. A binder 2 is for fixing the 1st electric conduction particle 3 in a binder 11, and the 2nd electric conduction particle 4 at the time of adhesion while pasting up the TFT substrate 11 and the flexible base film 13. Such a binder 2 consists of macromolecule adhesives, such as the ingredient of the binder of the usual anisotropy electric conduction film, for example, thermoplastics, and thermosetting resin. As thermoplastics, resin, such as an urethane system and a polyester system, is used, for example, and resin, such as an epoxy system and a phenol system, is used as thermosetting resin, for example.

[0013] The 1st electric conduction particle 3 is in the condition which pasted up the TFT substrate 11 and the flexible base film 13, and is mixed into the binder 2 by the consistency in contact with the 1st terminal 12 of the TFT substrate 11, and the 2nd terminal 14 of the flexible base film 13. Moreover, it is mixed into the binder 2 by the low consistency of extent which does not contact the 1st electric conduction particle 3 which adjoins with this.

[0014] The above-mentioned 1st electric conduction particle 3 consists of a particle of very low resistance with the resistance near about 0 ohm. For example, it consists of compound plastics which becomes elasticity resin particles, such as a phenol system, a styrene system, and an epoxy system, from metal particles, such as metal membrane covering plastics, nickel, solder, etc. which carried out plating processing of the nickel metallurgy, and resin and metal particles. The 2nd electric conduction particle 4 consists of a particle which has resistance higher than the resistance of the 1st electric conduction particle 3. This resistance is set to extent out of which the effect of the cross talk between channels or leak nature does not come, for example, the high resistance of 1 M omega - 10 M omega. Making the range of resistance into the range of 1 M omega - 10 M omega here is based on the following reasons.

[0015] That is, when resistance is smaller than 1 M omega, it is because there is a possibility that the cross talk between channels and the effect of leak nature may come out. Moreover, when 10 M omega was exceeded, insulation becomes high too much and static electricity invades from the terminal at the tip of the flexible base film 13, it is because the potential difference is impressed to a device like TFT of LCD as it is.

[0016] Moreover, the 2nd electric conduction particle 4 is in the condition which pasted up the TFT substrate 11 and the flexible base film 13, and is mixed into the binder 2 by the consistency of extent in contact with the adjoining 2nd electric conduction particle 4. That is, the 2nd electric conduction particle 4 is in the condition of existing in high density in a binder 2 from the 1st electric conduction particle 3.

[0017] As such a 2nd electric conduction particle 4, it is higher than the resistance of the 1st electric conduction particle 3, and if it is the resistance which is neither a cross talk between channels, nor that of the effect of leak nature, various things can be used. For example, what changed the metal membrane of the above-mentioned metal membrane covering plastics to the ingredient with high resistance may be used. Moreover, although drawing 1 shows the case where the 2nd electric conduction particle 4 is constituted from one kind of ingredient, it is also possible to constitute the 2nd electric conduction particle 4 from two or more sorts of ingredients.

[0018] In addition, the mean diameter of the above-mentioned 1st electric conduction particle 3 and the 2nd electric conduction particle 4 is set up with the pitch of the 1st terminal 12 connected and the 2nd terminal 14. Moreover, in this case, even if the mean particle diameter of the 1st electric conduction particle 3 and the 2nd electric conduction particle 4 is almost the same, you may differ. However, it is in the condition which pasted up the TFT substrate 11 and the flexible base film 13, and it is required to fulfill the conditions that 2nd electric conduction particle 4 comrades which adjoin while the 1st electric

conduction particle 3 contacts the 1st terminal 12 and the 2nd terminal 14 contact. Therefore, the mean particle diameter of the 2nd electric conduction particle 4 is the same as the mean particle diameter of the 1st electric conduction particle 3, or it is desirable that it is smaller than it. It is especially desirable to set up small the mean particle diameter of the 2nd electric conduction particle 4 rather than the mean particle diameter of the 1st electric conduction particle 3 in the case where the 2nd electric conduction particle 4 is a particle harder than the 1st electric conduction particle 3.

[0019] When connecting the TFT substrate 11 and the flexible base film 13 using the above-mentioned anisotropy electric conduction film 1, the anisotropy electric conduction film 1 is made to intervene between the TFT substrate 11 and the flexible base film 13 as usual. And in this condition, the TFT substrate 11 and the flexible base film 13 are pasted up by applying heat and a pressure in the thickness direction of the anisotropy electric conduction film 1.

[0020] As shown in drawing 2 , the 1st electric conduction particle 3 of the anisotropy electric conduction film 1 is crushed by this thermocompression bonding, and the 1st terminal 12 and the 2nd terminal 14 are contacted by it. Moreover, since the 1st electric conduction particle 3 exists by the low consistency in a binder 2, adjoining things do not contact. Consequently, the 1st terminal 12 and the 2nd terminal 14 will be in the condition of flowing through the 1st electric conduction particle 3. That is, when the TFT substrate 11 and the flexible base film 13 are pasted up up and down, the conductivity of the vertical direction is obtained. Moreover, since the 1st electric conduction particle 3 consists of a particle of low resistance, it can be made to flow through the vertical direction in low resistance.

[0021] Moreover, if it is in the 2nd electric conduction particle 4 of the anisotropy electric conduction film 1, since it exists by high density in a binder 2, those which adjoin by the above-mentioned thermocompression bonding contact. Consequently, the conductivity of high resistance can be obtained in the longitudinal direction between the 1st terminal 12 and the 2nd terminal 14. In addition, since a current flows to the low 1st electric conduction particle 3 of resistance even if it contacts the 1st terminal 12 and the 2nd terminal 14, there is no effect of the four 2nd electric conduction particle in the conductivity of the 1st terminal 12 and the 2nd terminal 14.

[0022] It can be made to flow through a longitudinal direction by high resistance by the anisotropy electric conduction film 1 of the 1st operation gestalt in the condition of having pasted up the TFT substrate 11 and the flexible base film 13 up and down, as mentioned above. For this reason, even when static electricity invades even if from the terminal by the side of the tip of the flexible base film 13, it can suppress that the potential difference occurs between the 1st terminal 12 and the 2nd terminal 14, and can control that the device of LCD receives a damage with static electricity. And by the anisotropy electric conduction film 1, the conventional connectability is maintained by that which can make it flow through the vertical direction in low resistance. Therefore, according to the anisotropy electric conduction film 1, while being able to attain low resistance-ization of a flow of the vertical direction, the electrostatic discharge of LCD can be prevented.

[0023] Next, the anisotropy electric conduction film concerning the 2nd operation gestalt is explained using drawing 3 R> 3 and drawing 4 . In addition, the 2nd operation gestalt shows 1 operation gestalt of invention of claim 2. Moreover, in the 2nd operation gestalt, the same sign will be given to the same formative element as the 1st operation gestalt. That it is different from the 1st operation gestalt mentioned above in the 2nd operation gestalt is the point that the binder 6 of the anisotropy electric conduction film 5 consists of an ingredient which has high resistance, and the 2nd electric conduction particle 4 in the 1st operation gestalt is not mixed into the binder 6.

[0024] That is, the anisotropy electric conduction film 5 is formed in the shape of film from the 1st electric conduction particle 3 mixed into the binder 6 and the binder 6. The binder 6 consists of insulating materials which have resistance higher than the resistance of the 1st electric conduction particle 3. This resistance is set as the high resistance of 1 M omega - 10 M omega like the 2nd electric conduction particle 4 of extent out of which the effect of the cross talk between channels or leak nature does not come, for example, the 1st operation gestalt. It is the same as that of the reason

explained with the 1st operation gestalt to make the range of resistance into the range of 1 M omega - 10 M omega here.

[0025] As such a binder 6, a thing like carbon black in which the resistivity of a proper mixed the conductor of the range of 0.1 ohm-cm - 10 ohm-cm, for example is mentioned, for example to giant-molecule adhesives, such as the ingredient of the binder of the usual anisotropy electric conduction film, i.e., thermoplastics, and thermosetting resin. As thermoplastics, resin, such as an urethane system and a polyester system, is used, for example, and resin, such as an epoxy system and a phenol system, is used as thermosetting resin, for example. Moreover, it is what mixed dopants, such as an organic molecule and a macromolecule, in a chain-like conjugated-system organic macromolecule or organic macromolecules other than this, and it is also possible to use for a binder 6 the macromolecule adhesives with which what functions as adhesives, and the very thing have the conductivity of high resistance. As an example, what mixed the surfactant in macromolecule adhesives is mentioned.

[0026] If carbon black is particle shape when what mixed carbon black in giant-molecule adhesives is used as a binder 6, it is possible to control the resistance of a binder 6 by the particle size and amount of mixing. Moreover, if carbon black is fibrous, the resistance of a binder 6 is further controllable by the die length.

[0027] The 1st electric conduction particle 3 is in the 1st operation gestalt and the condition which pasted up the TFT substrate 11 and the flexible base film 13 similarly, and is mixed into the binder 6 by the consistency in contact with the 1st terminal 12 of the TFT substrate 11, and the 2nd terminal 14 of the flexible base film 13. Moreover, it is mixed into the binder 6 by the low consistency of extent which does not contact the 1st electric conduction particle 3 which adjoins with this. Furthermore, the 1st electric conduction particle 3 consists of a particle of very low resistance with the resistance near about 0. For example, it consists of compound plastics which becomes elasticity resin particles, such as a phenol system, a styrene system, and an epoxy system, from metal particles, such as metal membrane covering plastics, nickel, solder, etc. which carried out plating processing of the nickel metallurgy, and resin and metal particles.

[0028] When connecting the TFT substrate 11 and the flexible base film 13 using the above-mentioned anisotropy electric conduction film 5, the anisotropy electric conduction film 5 is made to intervene between the TFT substrate 11 and the flexible base film 13 like the 1st operation gestalt. And in this condition, the TFT substrate 11 and the flexible base film 13 are pasted up by applying heat and a pressure in the thickness direction of the anisotropy electric conduction film 5.

[0029] As shown in drawing 4 </A>, the 1st electric conduction particle 3 of low resistance of the anisotropy electric conduction film 5 is crushed by this thermocompression bonding, and the 1st terminal 12 and the 2nd terminal 14 are contacted by it. Consequently, when the conductivity 11, i.e., the TFT substrate, and the flexible base film 13 of low resistance are pasted up up and down the 1st terminal 12, the 2nd terminal 14, and in between, the conductivity of low resistance is obtained in the vertical direction.

[0030] Moreover, since the 1st electric conduction particle 3 exists by the low consistency in a binder 2, adjoining things do not contact, therefore the conductivity of low resistance is not obtained in the longitudinal direction between the 1st terminal 12 and the 2nd terminal 14. On the other hand, since a binder 6 consists of an ingredient of high resistance, the conductivity of high resistance can be obtained with this binder 6 in the longitudinal direction between the 1st terminal 12 and between the 2nd terminal 14. In addition, since a current flows to the low 1st electric conduction particle 3 of resistance even if it contacts the 1st terminal 12 and the 2nd terminal 14, there is no effect of six binder in the conductivity of the 1st terminal 12 and the 2nd terminal 14.

[0031] Thus, while being able to make it flow through the vertical direction in low resistance, it can be made to flow through a longitudinal direction in high resistance also in the anisotropy electric conduction film 5 of the 2nd operation gestalt in the condition of having pasted up the TFT substrate 11 and the flexible base film 13 up and down. For this reason, even when static electricity invades even if from the

terminal by the side of the tip of the flexible base film 13, it can control that the device of LCD receives a damage with static electricity. Therefore, the effectiveness that the electrostatic discharge of LCD can be prevented is acquired also with the anisotropy electric conduction film 5 of the 2nd operation gestalt, without spoiling the conventional connectability. In addition, although this invention was applied to connection between the TFT substrate of LCD, and a flexible base film with this operation gestalt, it cannot be overemphasized that this invention can be used for connection between the other circuit boards.

[0032]

[Effect of the Invention] As explained above, when according to the anisotropy electric conduction film concerning claim 1 the anisotropy electric conduction film is made to intervene between the 1st substrate and the 2nd substrate and the 1st substrate and the 2nd substrate are pasted up, it can be made to flow through the terminal of the 1st substrate, and the terminal of the 2nd substrate through the 1st electric conduction particle. Moreover, by the 2nd electric conduction particle, the conductivity of high resistance can be obtained rather than the resistance of the 1st electric conduction particle in the longitudinal direction between the terminal of the 1st substrate, and the terminal of the 2nd substrate. For this reason, since the potential difference can control going into the device formed in the 1st substrate or the 2nd substrate as it was even when static electricity invades from the above-mentioned longitudinal direction even if, the electrostatic discharge of the device of the 1st substrate or the 2nd substrate can be prevented, without spoiling the conventional connectability.

[0033] Moreover, when according to the anisotropy electric conduction film concerning claim 2 the anisotropy electric conduction film is made to intervene between the 1st substrate and the 2nd substrate and the 1st substrate and the 2nd substrate are pasted up, it can be made to flow through the terminal of the 1st substrate, and the terminal of the 2nd substrate through the 1st electric conduction particle. Moreover, with a binder, the conductivity of high resistance can be obtained rather than the resistance of the 1st electric conduction particle in the longitudinal direction between the terminal of the 1st substrate, and the terminal of the 2nd substrate. Therefore, the effectiveness that the electrostatic discharge of the device formed in the 1st substrate or the 2nd substrate can be prevented is acquired like claim 1, without spoiling the conventional connectability.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is a sectional view for explaining the anisotropy electric conduction film of the 1st operation gestalt, and is drawing showing 1 operation gestalt of invention of claim 1.

[Drawing 2] It is the sectional view showing the condition of having pasted up using the anisotropy electric conduction film of the 1st operation gestalt.

[Drawing 3] It is a sectional view for explaining the anisotropy electric conduction film of the 2nd operation gestalt, and is drawing showing 1 operation gestalt of invention of claim 2.
[Drawing 4] It is the sectional view showing the condition of having pasted up using the anisotropy electric conduction film of the 2nd operation gestalt.
[Drawing 5] It is a sectional view for explaining the conventional anisotropy electric conduction film.
[Description of Notations]
1 Five Anisotropy electric conduction film 2 Six Binder 3 The 1st electric conduction particle
4 2nd Electric Conduction Particle 11 TFT Substrate 12 1st Terminal
13 Flexible Base Film 14 2nd Terminal

[Translation done.]

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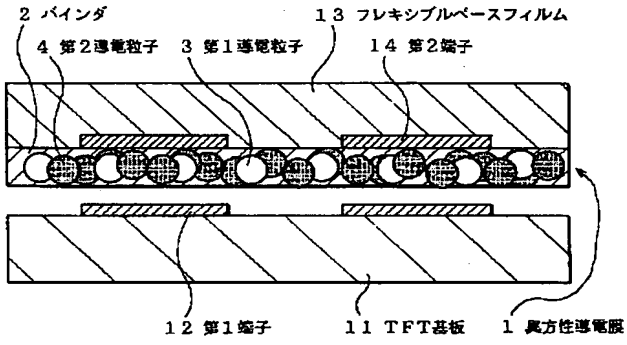
(54)【発明の名称】　異方性導電膜

(57)【要約】

【課題】　第１基板と第２基板との間に介在させて第１基板と第２基板とを上下に接着した場合に、横方向からの静電気の侵入による第１基板、第２基板のデバイスの静電破壊を防止する。

【解決手段】　異方性導電膜１は、絶縁材料からなるバインダ２中に、第１導電粒子３と、第１導電粒子３の抵抗値よりも高い抵抗値を有する第２導電粒子４とが混入されてなる。第１導電粒子３は、ＴＦＴ基板（第１基板）１１とフレキシブルベースフィルム（第２基板）１３とを接着した状態で第１端子１２と第２端子１４とに接触しかつ隣接する第１導電粒子３と接触しない密度でバインダ２中に混入されているものであり、第２導電粒子４は、ＴＦＴ基板１１とフレキシブルベースフィルム１３とを接着した状態で隣接する第２導電粒子４と接触する密度でバインダ２中に混入されているものである。



第１実施形態を示す断面図

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【特許請求の範囲】

【請求項１】　第１基板と第２基板との間に介在させて、該第１基板の端子と該端子に対向する前記第２基板の端子とを導通させた状態でこれら第１基板と第２基板とを接着させるための異方性導電膜であって、

絶縁材料からなるバインダと、

該バインダ中に混入された第１導電粒子と、

前記バインダ中に混入されたもので前記第１導電粒子の抵抗値よりも高い抵抗値を有する第２導電粒子とを備え、

前記第１導電粒子は、前記第１基板と第２基板とを接着した状態で該第１基板の端子と第２基板の端子とに接触しかつ隣接する第１導電粒子と接触しない密度で前記バインダ中に混入され、

前記第２導電粒子は、前記第１基板と第２基板とを接着した状態で隣接する第２導電粒子と接触する密度で前記バインダ中に混入されてなることを特徴とする異方性導電膜。

【請求項２】　第１基板と第２基板との間に介在させて、該第１基板の端子と該端子に対向する前記第２基板の端子とを導通させた状態でこれら第１基板と第２基板とを接着させるための異方性導電膜であって、

導電粒子がバインダ中に混入されてなるもので、

前記導電粒子は、前記第１基板と第２基板とを接着した状態で該第１基板の端子と第２基板の端子とに接触しかつ隣接する導電粒子と接触しない密度で前記バインダ中に混入され、

前記バインダは、前記導電粒子の抵抗値よりも高い抵抗値を有する材料からなることを特徴とする異方性導電膜。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、電子機器における回路基板間の接続に用いる異方性導電膜に関するものである。

【０００２】

【従来の技術】電子機器における回路基板間の接続技術の一つに、異方性導電膜を用いる技術がある。従来、この技術は、例えばリジット（硬質）基板とフレキシブル基板との接続やフレキシブル基板同士の接続に適用されている。特に、液晶表示素子（以下、ＬＣＤと記す）の製造では、ＬＣＤと外部回路基板との接続にフレキシブル基板を用いることが多い。このことから近年では、図５に示すようにリジット基板であるＬＣＤのＴＦＴ（薄膜トランジスタ）基板５１とフレキシブル基板５３との接続に異方性導電膜６０を用いることが提案されている。

【０００３】通常、異方性導電膜６０は、接着剤であるバインダ（支持体）６１中に低い接触抵抗を有する導電粒子６２を混入させ、これを膜状に形成したものからなっている。異方性導電膜６０を用いた接続では、例えばＴＦＴ基板５１とフレキシブル基板５３との間に異方性導電膜６０を介在させ、この状態で異方性導電膜６０の厚み方向に圧力を加えることにより、ＴＦＴ基板５１とフレキシブル基板５３とを接着させる。その接着の際、ＴＦＴ基板５１の端子電極５２と、この端子電極５２に対向するフレキシブル基板５３の電極５４との間で、バインダ６１中の導電粒子６２が押しつぶされて端子電極５２と電極５４間（上下方向）の導通が得られる。なお、ＴＦＴ基板５１とフレキシブル基板５３とを接着した状態で横方向の絶縁性を確保するために、異方性導電膜６０の導電粒子６２は、隣接するもの同士接触しない程度の密度でバインダ６１中に混入されている。

【０００４】このように異方性導電膜６０は、厚み方向に圧力を加えられた場合、導電粒子６２により上下方向の導通が取られる一方、横方向の絶縁性が維持され、結果として異方性を確保するものとなっている。

【０００５】

【発明が解決しようとする課題】ところで、異方性導電膜は、従来よりその導通の低抵抗化と異方性とを中心にして開発されてきている。このため、横方向の絶縁性が高い現在の異方性導電膜では、例えばフレキシブル基板の先端の端子から静電気が侵入した場合、その電位差が保たれたままＬＣＤのデバイスに印加される。結果として、デバイスが静電気によりダメージを受け、ＬＣＤが静電破壊されるといった不具合が生じている。

【０００６】

【課題を解決するための手段】上記課題を解決するために請求項１に係る異方性導電膜は、第１基板と第２基板との間に介在させて、第１基板の端子とこの端子に対向する第２基板の端子とを導通させた状態でこれら第１基板と第２基板とを接着させるためのものであって、絶縁材料からなるバインダと、バインダ中に混入された第１導電粒子と、バインダ中に混入されたもので第１導電粒子の抵抗値よりも高い抵抗値を有する第２導電粒子とを備えてなる。そして、上記第１導電粒子が、第１基板と第２基板とを接着した状態で第１基板の端子と第２基板の端子とに接触しかつ隣接する第１導電粒子と接触しない密度でバインダ中に混入されてなるものである。また上記第２導電粒子が、第１基板と第２基板とを接着した状態で隣接する第２導電粒子と接触する密度でバインダ中に混入されてなるものである。

【０００７】この発明の異方性導電膜では、第１基板と第２基板との間に介在させて第１基板と第２基板とを接着させた場合に、第１導電粒子が第１基板の端子とこの端子に対向する第２基板の端子とに接触し、かつ隣接する第１導電粒子同士は接触しない。このため、第１基板の端子と第２基板の端子とは第１導電粒子を介して導通する。一方、第２導電粒子は隣接するもの同士が接触する。この第２導電粒子は第１導電粒子の抵抗値よりも高

い抵抗値を有するので、第２導電粒子によって、第１基板および第２基板の端子間の横方向にて第１導電粒子の抵抗値よりも高抵抗の導通性が得られる。また第２導電粒子が、第１基板の端子と第２基板の端子とに接触しても、電流は抵抗値の低い第１導電粒子へと流れることから、第１基板の端子と第２基板の端子との導通性に影響はない。

【０００８】請求項２に係る異方性導電膜は、第１基板と第２基板との間に介在させて、第１基板の端子とこの端子に対向する第２基板の端子とを導通させた状態でこれら第１基板と第２基板とを接着させるためのものであって、導電粒子がバインダ中に混入されてなるものである。そして上記導電粒子が、第１基板と第２基板とを接着した状態で第１基板の端子と第２基板の端子とに接触しかつ隣接する導電粒子と接触しない密度でバインダ中に混入されなるものである。またバインダが、導電粒子の抵抗値よりも高い抵抗値を有する材料からなるものである。

【０００９】この発明の異方性導電膜では、第１基板と第２基板との間に介在させて第１基板と第２基板とを接着させた場合に、第１導電粒子が第１基板の端子とこの端子に対向する第２基板の端子とに接触し、かつ隣接する第１導電粒子同士は接触しない。このため、第１基板の端子と第２基板の端子とは第１導電粒子を介して導通する。一方、バインダが第１導電粒子の抵抗値よりも高い抵抗値を有するので、バインダによって第１基板の端子および第２基板の端子間の横方向にて第１導電粒子の抵抗値よりも高抵抗の導通性が得られる。またバインダが、第１基板の端子と第２基板の端子とに接触しても、電流は抵抗値の低い第１導電粒子へと流れることから、第１基板の端子と第２基板の端子との導通性に影響はない。

【００１０】

【発明の実施の形態】以下、本発明に係る異方性導電膜の実施形態を図面に基づいて説明する。なお、本実施形態では、第１基板であるＬＣＤのＴＦＴ基板と第２基板である信号入力用のフレキシブルベースフィルムとの接続に本発明を適用した場合について述べる。図１は第１実施形態に係る異方性導電膜を説明する図であり、請求項１の発明の一実施形態を示すものである。

【００１１】この異方性導電膜１は、ＴＦＴ基板１１とフレキシブルベースフィルム１３との間に介在させて、これらＴＦＴ基板１１とフレキシブルベースフィルム１３とを接着させるためのものである。また接着した状態で、ＴＦＴ基板１１の端子電極（以下、第１端子と記す）１２と、この第１端子１２に対向するフレキシブルベースフィルム１３の電極（以下、第２端子と記す）１４を導通させるためのものである。

【００１２】異方性導電膜１は、絶縁材料からなるバインダ２と、バインダ２中に混入された第１導電粒子３および第２導電粒子４とから、膜状に形成されている。バインダ２は、ＴＦＴ基板１１とフレキシブルベースフィルム１３とを接着するとともに、接着時にバインダ１１中の第１導電粒子３、第２導電粒子４を固定するためのものである。このようなバインダ２は、通常の異方性導電膜のバインダの材料、例えば熱可塑性樹脂や熱硬化性樹脂等の高分子接着剤で構成されている。熱可塑性樹脂としては、例えばウレタン系、ポリエステル系等の樹脂が用いられ、熱硬化性樹脂としては、例えばエポキシ系、フェノール系等の樹脂が用いられる。

【００１３】第１導電粒子３は、ＴＦＴ基板１１とフレキシブルベースフィルム１３とを接着した状態で、ＴＦＴ基板１１の第１端子１２とフレキシブルベースフィルム１３の第２端子１４とに接触する密度でバインダ２中に混入されている。またこれとともに、隣接する第１導電粒子３と接触しない程度の低密度でバインダ２中に混入されている。

【００１４】上記第１導電粒子３は、抵抗値がほぼ０Ωに近い非常に低抵抗の粒子からなっている。例えばフェノール系、スチレン系、エポキシ系等の軟質樹脂粒子にニッケルや金をメッキ処理した金属膜被覆プラスチックや、ニッケルやはんだ等の金属粒子、樹脂と金属粒子とからなる複合プラスチック等で構成されている。第２導電粒子４は、第１導電粒子３の抵抗値よりも高い抵抗値を有する粒子からなっている。この抵抗値は、チャンネル間のクロストークやリーク性の影響のでない程度、例えば１ＭΩ～１０ＭΩの高い抵抗値に設定される。ここで抵抗値の範囲を例えば１ＭΩ～１０ＭΩの範囲にするのは、以下の理由による。

【００１５】すなわち、抵抗値が１ＭΩより小さいと、チャンネル間のクロストークやリーク性の影響がでる恐れがあるためである。また１０ＭΩを越えると、絶縁性が高くなり過ぎて、フレキシブルベースフィルム１３の先端の端子から静電気が侵入した場合に、その電位差がそのままＬＣＤのＴＦＴのようなデバイスに印加されるためである。

【００１６】また第２導電粒子４は、ＴＦＴ基板１１とフレキシブルベースフィルム１３とを接着した状態で、隣接する第２導電粒子４と接触する程度の密度でバインダ２中に混入されている。つまり、第２導電粒子４は、第１導電粒子３よりも高密度にバインダ２中に存在している状態になっている。

【００１７】このような第２導電粒子４としては、第１導電粒子３の抵抗値よりも高く、チャンネル間のクロストークやリーク性の影響のでない抵抗値であれば、種々のものを用いることができる。例えば上記した金属膜被覆プラスチックの金属膜を、抵抗値の高い材料に替えたようなものを用いてもよい。また図１では、１種類の材料で第２導電粒子４を構成した場合を示しているが、複数種の材料で第２導電粒子４を構成することも可能であ

る。

【００１８】なお、上記した第１導電粒子３および第２導電粒子４の平均粒径は、接続される第１端子１２および第２端子１４のピッチにより設定される。またこの場合、第１導電粒子３と第２導電粒子４との平均粒径がほぼ同じであっても異なっていてもよい。ただし、ＴＦＴ基板１１とフレキシブルベースフィルム１３とを接着した状態で、第１導電粒子３が第１端子１２と第２端子１４とに接触するとともに隣接する第２導電粒子４同士が接触するといった条件を満たすことが必要である。よって、第２導電粒子４の平均粒径は、第１導電粒子３の平均粒径と同じかそれよりも小さいことが好ましい。特に第２導電粒子４が第１導電粒子３よりも硬い粒子である場合では、第１導電粒子３の平均粒径よりも第２導電粒子４の平均粒径を小さく設定することが望ましい。

【００１９】上記した異方性導電膜１を用いてＴＦＴ基板１１とフレキシブルベースフィルム１３とを接続する場合には、従来と同様、ＴＦＴ基板１１とフレキシブルベースフィルム１３との間に異方性導電膜１を介在させる。そしてこの状態で、異方性導電膜１の厚み方向に熱および圧力を加えることにより、ＴＦＴ基板１１とフレキシブルベースフィルム１３とを接着する。

【００２０】この熱圧着によって、図２に示すように、異方性導電膜１の第１導電粒子３が押しつぶされて第１端子１２と第２端子１４とに接触する。また第１導電粒子３はバインダ２中に低密度で存在しているため、隣接するもの同士が接触しない。その結果、第１端子１２と第２端子１４とが第１導電粒子３を介して導通する状態になる。すなわちＴＦＴ基板１１とフレキシブルベースフィルム１３とを上下に接着した場合において上下方向の導通性が得られる。また第１導電粒子３は低抵抗の粒子からなるので、上下方向を低抵抗で導通させることができる。

【００２１】また異方性導電膜１の第２導電粒子４にあっては、バインダ２中に高密度で存在しているので、上記熱圧着によって隣接するもの同士が接触する。この結果、第１端子１２および第２端子１４間の横方向にて高抵抗の導通性を得ることができる。なお、第２導電粒子４が、第１端子１２と第２端子１４とに接触しても、電流は抵抗値の低い第１導電粒子３へと流れることから、第１端子１２と第２端子１４との導通性に影響はない。

【００２２】以上のように第１実施形態の異方性導電膜１では、ＴＦＴ基板１１とフレキシブルベースフィルム１３とを上下に接着した状態において、横方向を高抵抗で導通させることができる。このため、たとえフレキシブルベースフィルム１３の先端側の端子から静電気が侵入した場合でも、第１端子１２および第２端子１４間で電位差が発生するのを抑えることができ、ＬＣＤのデバイスが静電気によりダメージを受けることを抑制できる。しかも異方性導電膜１では上下方向を低抵抗で導通させることができので、従来の接続性が維持される。したがって、異方性導電膜１によれば、上下方向の導通の低抵抗化を図ることができるとともに、ＬＣＤの静電破壊を防止することができる。

【００２３】次に第２実施形態に係る異方性導電膜を図３および図４を用いて説明する。なお、第２実施形態は請求項２の発明の一実施形態を示すものである。また、第２実施形態において第１実施形態と同一の形成要素には同一の符号を付すことにする。第２実施形態において前述した第１実施形態と相違するのは、異方性導電膜５のバインダ６が高い抵抗値を有する材料からなり、かつ第１実施形態における第２導電粒子４がバインダ６中に混入されていない点である。

【００２４】すなわち、異方性導電膜５は、バインダ６と、バインダ６中に混入された第１導電粒子３とから、膜状に形成されている。バインダ６は、第１導電粒子３の抵抗値よりも高い抵抗値を有する絶縁材料から構成されている。この抵抗値は、チャンネル間のクロストークやリーク性の影響のでない程度、例えば第１実施形態の第２導電粒子４と同様、１ＭΩ～１０ＭΩの高い抵抗値に設定される。ここで抵抗値の範囲を例えば１ＭΩ～１０ＭΩの範囲にするのは、第１実施形態で述べた理由と同様である。

【００２５】このようなバインダ６としては、例えば通常の異方性導電膜のバインダの材料、すなわち熱可塑性樹脂や熱硬化性樹脂等の高分子接着剤に、カーボンブラックのような例えば固有の比抵抗値が０．１Ω・ｃｍ～１０Ω・ｃｍの範囲の導体を混入したものが挙げられる。熱可塑性樹脂としては、例えばウレタン系、ポリエステル系等の樹脂が用いられ、熱硬化性樹脂としては、例えばエポキシ系、フェノール系等の樹脂が用いられる。また、鎖状共役系有機高分子やこれ以外の有機高分子に有機分子、高分子等のドーパントを混入したもので接着剤として機能するものや、そのものが高抵抗の導電性を有する高分子接着剤をバインダ６に用いることも可能である。一例としては、高分子接着剤に界面活性剤を混入したものが挙げられる。

【００２６】高分子接着剤にカーボンブラックを混入したものをバインダ６とした場合には、カーボンブラックが粒子形状であれば、その粒径や混入量でバインダ６の抵抗値を制御することが可能である。またカーボンブラックが繊維状であれば、さらにその長さでバインダ６の抵抗値を制御することができる。

【００２７】第１導電粒子３は、第１実施形態と同様、ＴＦＴ基板１１とフレキシブルベースフィルム１３とを接着した状態で、ＴＦＴ基板１１の第１端子１２とフレキシブルベースフィルム１３の第２端子１４とに接触する密度でバインダ６中に混入されているものである。またこれとともに、隣接する第１導電粒子３と接触しない程度の低密度でバインダ６中に混入されているものであ

る。さらに第１導電粒子３は、抵抗値がほぼ０に近い非常に低抵抗の粒子からなっている。例えばフェノール系、スチレン系、エポキシ系等の軟質樹脂粒子にニッケルや金をメッキ処理した金属膜被覆プラスチックや、ニッケルやはんだ等の金属粒子、樹脂と金属粒子とからなる複合プラスチック等で構成されている。

【００２８】上記した異方性導電膜５を用いてＴＦＴ基板１１とフレキシブルベースフィルム１３とを接続する場合には、第１実施形態と同様、ＴＦＴ基板１１とフレキシブルベースフィルム１３との間に異方性導電膜５を介在させる。そしてこの状態で、異方性導電膜５の厚み方向に熱および圧力を加えることにより、ＴＦＴ基板１１とフレキシブルベースフィルム１３とを接着する。

【００２９】この熱圧着によって、図４に示すように、異方性導電膜５の低抵抗の第１導電粒子３が押しつぶされて第１端子１２と第２端子１４とに接触する。その結果、第１端子１２と第２端子１４と間に低抵抗の導通性、すなわちＴＦＴ基板１１とフレキシブルベースフィルム１３とを上下に接着した場合において上下方向で低抵抗の導通性が得られる。

【００３０】また第１導電粒子３はバインダ２中に低密度で存在しているため、隣接するもの同士が接触せず、したがって第１端子１２および第２端子１４間の横方向にて低抵抗の導通性が得られることがない。一方、バインダ６が高抵抗の材料からなるので、このバインダ６によって第１端子１２間、第２端子１４間の横方向にて高抵抗の導通性を得ることができる。なお、バインダ６が、第１端子１２と第２端子１４とに接触しても、電流は抵抗値の低い第１導電粒子３へと流れることから、第１端子１２と第２端子１４との導通性に影響はない。

【００３１】このように第２実施形態の異方性導電膜５においても、ＴＦＴ基板１１とフレキシブルベースフィルム１３とを上下に接着した状態において、上下方向を低抵抗で導通させることができるとともに横方向を高抵抗で導通させることができる。このため、たとえフレキシブルベースフィルム１３の先端側の端子から静電気が侵入した場合でも、ＬＣＤのデバイスが静電気によりダメージを受けることを抑制できる。したがって第２実施形態の異方性導電膜５によっても、従来の接続性を損なうことなくＬＣＤの静電破壊を防止できるといった効果が得られる。なお、本実施形態では、ＬＣＤのＴＦＴ基板とフレキシブルベースフィルムとの接続に本発明を適用したが、この他の回路基板間の接続に本発明を用いることができるのは言うまでもない。

【００３２】

【発明の効果】以上説明したように請求項１に係る異方性導電膜によれば、第１基板と第２基板との間に異方性導電膜を介在させて第１基板と第２基板とを接着した場合に、第１導電粒子を介して第１基板の端子と第２基板の端子とを導通させることができる。また第２導電粒子により、第１基板の端子および第２基板の端子間の横方向にて第１導電粒子の抵抗値よりも高抵抗の導通性を得ることができる。このため、たとえ上記横方向から静電気が侵入した場合でも、電位差がそのまま第１基板や第２基板に形成されたデバイスに入ることを抑制できるので、従来の接続性を損なうことなく第１基板や第２基板のデバイスの静電破壊を防止することができる。

【００３３】また請求項２に係る異方性導電膜によれば、第１基板と第２基板との間に異方性導電膜を介在させて第１基板と第２基板とを接着した場合に、第１導電粒子を介して第１基板の端子と第２基板の端子とを導通させることができる。またバインダにより、第１基板の端子および第２基板の端子間の横方向にて第１導電粒子の抵抗値よりも高抵抗の導通性を得ることができる。したがって、請求項１と同様、従来の接続性を損なうことなく、第１基板や第２基板に形成されたデバイスの静電破壊を防止できるといった効果が得られる。

【図面の簡単な説明】

【図１】第１実施形態の異方性導電膜を説明するための断面図であり、請求項１の発明の一実施形態を示す図である。

【図２】第１実施形態の異方性導電膜を用いて接着した状態を示す断面図である。

【図３】第２実施形態の異方性導電膜を説明するための断面図であり、請求項２の発明の一実施形態を示す図である。

【図４】第２実施形態の異方性導電膜を用いて接着した状態を示す断面図である。

【図５】従来の異方性導電膜を説明するための断面図である。

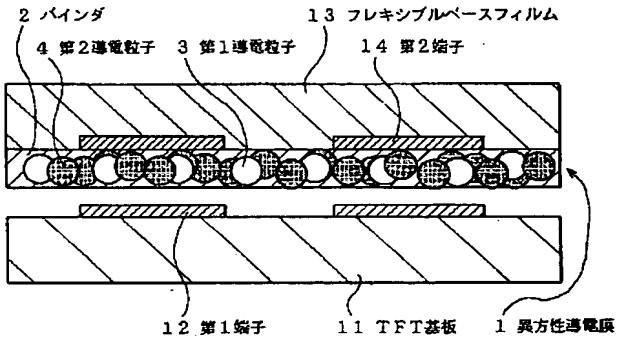
【符号の説明】

１、５　異方性導電膜　　２、６　バインダ　　３　第１導電粒子

４　第２導電粒子　　１１　ＴＦＴ基板　　１２　第１端子

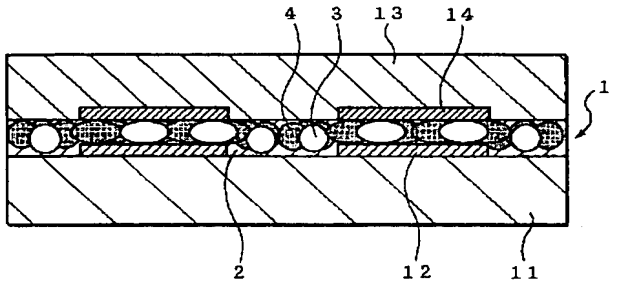
１３　フレキシブルベースフィルム　　１４　第２端子

【図１】



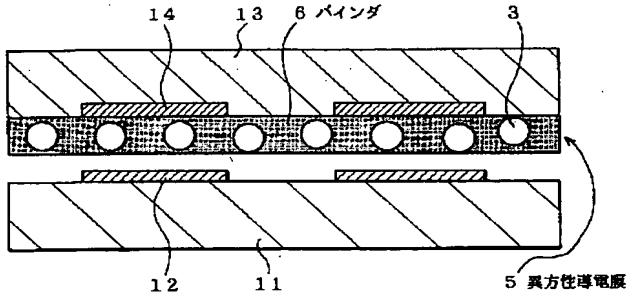
第１実施形態を示す断面図

【図２】



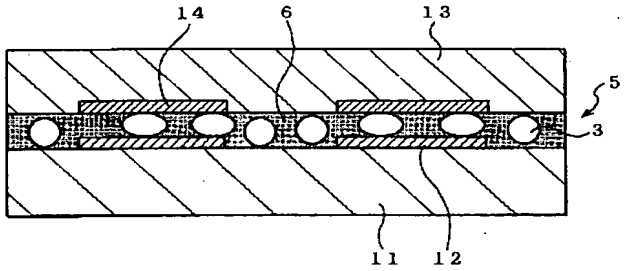
接着状態を示す断面図

【図３】



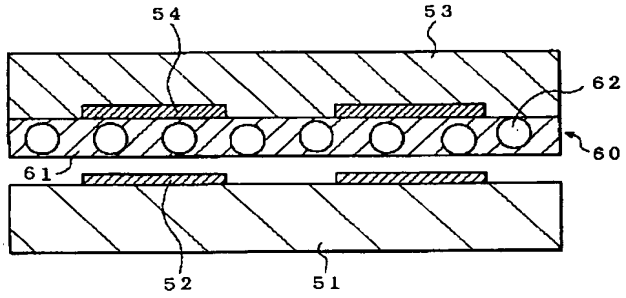
第２実施形態を示す断面図

【図４】



接着状態を示す断面図

【図５】



従来例を示す断面図

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